

## **Ferromagnetic-metal nanocomposite films as a possible candidate for left-handed materials**

S. Tomita<sup>1</sup>, K. Akamatsu<sup>2</sup>, H. Shinkai<sup>2</sup>, S. Ikeda<sup>2</sup>, H. Nawafune<sup>2</sup>, C. Mitsumata<sup>3</sup>, T. Kashiwagi<sup>4</sup>, and M. Hagiwara<sup>4</sup>

<sup>1</sup> PRESTO, Japan Science and Technology Agency (JST), Wako, Saitama, Japan

<sup>2</sup> Faculty of Science and Engineering, Konan Univ., Okamoto, Kobe, Japan

<sup>3</sup> Advanced Electronics Laboratory, Hitachi Metals Ltd., Kumagaya, Saitama, Japan

<sup>4</sup> Research Center for Materials Science at Extreme Conditions, Osaka Univ., Toyonaka, Osaka, Japan

Recently, a novel route to materials with both permittivity and permeability negative, called left-handed materials (LHMs), in the region of microwaves using ferromagnetic-metal nanocomposites has been proposed [1]. In this study, we prepared nanocomposite films consisting of metallic Ni nanoparticles several nanometers in diameter embedded in polymer matrices. It was found that diameter and volume fraction of the Ni particles can be controlled independently and precisely. These structural parameters strongly affected the electron magnetic resonance condition of the films. This suggests that the control of the film structures is important to tune the frequency where the LHMs may be obtained in this route.

[1] S.T. Chui and L. Hu, *Phys.Rev.B*, **65**, 144407 (2002).